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Antimicrobial Residues in Farmed Shrimp

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Brief reviewed by a multidisciplinary, multi-sector team of experts.

Summary of Findings

- Americans consume more shrimp than any other seafood, much of which is produced on farms in other countries.
- Antimicrobial drugs are detected occasionally in farmed shrimp, especially in shrimp originating from outside the United States (U.S.).
- While importing shrimp intended for food containing any antimicrobial is illegal, incentives remain for antimicrobial use by shrimp farmers.
- Many antimicrobials that have been found in farmed shrimp have the potential to cause illness in humans.
- Increasing use of 3rd party audits, increasing funding for residue testing, and enhancing veterinary infrastructure in exporting countries may help improve current U.S. regulation of farmed shrimp.

Background

The shrimp industry has changed dramatically in the last three decades. Historically, shrimp were harvested from the wild both domestically and abroad. Increasingly, shrimp are reared in aquaculture facilities where they are contained and fed in a controlled environment. The practice of shrimp farming began in Southeast Asia and is now widespread throughout Asia and Latin America. Shrimp farming is often regarded as a benefit to local economies, as well as an efficient means of protein production. However, the rapid expansion of shrimp farming has presented some unique challenges to food safety systems that were not designed to monitor intensively reared seafood.

Why should we care about farmed shrimp?

Americans consume more shrimp than any other seafood. About 40% of the shrimp Americans consume is produced on farms in Southeast Asia and Latin America. That constitutes about 500 million pounds of imported farmed shrimp annually, and that number is expected to grow as shrimp farming continues to expand.¹

Are drug residues in farmed shrimp a real public health concern?

Antimicrobial drugs have been detected occasionally in farmed shrimp, especially in shrimp originating from outside the United States (U.S.). To date, these drug residues have not caused any known human illnesses. Shrimp, from all sources, tend to have very low levels of mercury and dioxins—toxins that can be of concern with other seafood products.^{2,3,4}

A class of antimicrobials called nitrofurans has been responsible for the majority of residue violations in U.S. shrimp imports over the last decade.^{5,6,7} Nitrofurans (which include the drugs nitrofurazone and furazolidone) all have genotoxic properties, meaning that they may increase the risk of cancer in humans.⁸ Other antimicrobials also have been detected in imported farmed shrimp including chloramphenicol and fluoroquinolones.⁹ These antimicrobials, and others, are available from aquarium suppliers and other sources for use in non-food species.¹⁰ Antimicrobials, including nitrofurans, are considered an adulterant in fish and shrimp intended for food in the U.S. Importing shrimp into the U.S. containing any adulterating chemical or antimicrobial is illegal. A shipment in which adulterants have been detected is not permitted entry into the U.S.; this is called a “refusal,” or “refused entry into port.” A 2008 U.S. Food and Drug Administration (FDA) report summarized results from 2,134 aquaculture shipments (including shipments of fish, shrimp, and crab) that were sampled between 2005 and 2007. Of those aquaculture shipments sampled, 6.9% contained some illegal antimicrobial

residue. Shrimp shipments containing nitrofurans were responsible for 35% of all aquaculture import refusals in that time period.⁶ More recent data is incomplete, but forty shipments of farmed shrimp were refused at port due to detectable residues of nitrofurans between 2011 and 2013.¹¹

Why are antimicrobials used in aquaculture?

Farmers use antibiotics to treat a variety of diseases that can significantly affect shrimp mortality and production. In recent years, Early Mortality Syndrome (EMS) has emerged as a serious bacterial disease of farmed shrimp in Southeast Asia. For many bacterial pathogens, aggressive treatment of brood stock or larval shrimp with antimicrobials can significantly reduce mortality. No country officially condones the use of nitrofurans in shrimp production; nevertheless, these drugs are available through many suppliers and are highly effective broad-spectrum antimicrobials for aquaculture species, including shrimp. Despite the FDA's ongoing food safety programs and import regulations, there will continue to be economic incentive for shrimp producers to use potentially adulterating antimicrobials, including nitrofurans.

Who regulates antimicrobial residues in imported farmed shrimp?

The FDA has regulatory authority over farmed shrimp. The FDA targets its regulatory efforts by placing entire countries or individual companies with a history of antimicrobial residue violations under "Detention Without Physical Examination (DWPE)." Any exporting company that falls under a DWPE must supply antimicrobial residue analysis from a verified laboratory for each shrimp shipment received at a U.S. port. Companies that are not under a DWPE are subject to random inspection and residue testing by the FDA. A U.S. Government Accountability Office (GAO) audit in 2011 determined that only about 0.1% of shipments not under DWPE undergo physical inspection or antimicrobial residue testing.¹²

Will FSMA help control nitrofurans and other residues in shrimp?

The Food Safety Modernization Act (FSMA) is a new FDA food safety overhaul signed into law in 2011. The law has several proposed rules that address food safety from imported sources. However, farmed imported shrimp are exempted from the three major FSMA proposed rules that address food safety and drug residues. These rules include:

- Focused Mitigation Strategies to Protect Food Against Intentional Adulteration;
- Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventative Controls for Human Food; and
- Food Supplier Verification Programs (FSVP) for Importers of Food for Humans and Animals.

In sum, implementation of the current FSMA rules will not significantly change the regulatory environment of imported farmed shrimp.¹³

What are policy options to address antimicrobial residues in farmed shrimp?

1. Increase use of voluntary 3rd party auditing agencies.

Third party auditing agencies, such as The Global Aquaculture Alliance, provide an independent inspection and auditing service for large, U.S. seafood importers.¹⁴ Another FSMA rule, The Proposed Rule on Accreditation of 3rd Party Auditors, may support the development and standardization of 3rd party auditing services for foreign shrimp producers.¹⁵ Use of third party auditing may be of increasing importance in addressing food safety concerns in imported farmed shrimp.

2. Overhaul FDA regulation of imported seafood.

The FDA's regulation of imported seafood has evolved from regulating a predominantly wild capture fishery, to regulating an increasingly intensively farm-reared industry. The United Nations Food and Agriculture Organization (FAO) predicts that these trends of increased aquaculture production will continue.¹⁶ Ongoing disease pressures suggest that there will be continued financial incentive to use antimicrobials in farmed shrimp. It is unclear if the system of DWPE will offset financial gains of potentially adulterating antimicrobial use. Increased funding for residue testing and increasing penalties associated with residue detection may help mitigate the risks of illegal adulterating antimicrobials from entering the U.S. food supply.

3. Continue current focused inspection and residue testing.

Despite the occurrences of antimicrobial residues in farmed shrimp, the overall public health impact has been relatively small according to available data.¹⁷ The current policy of targeted inspection and residue testing may be the most cost effective approach at this time. Policies and procedures can be re-evaluated if long term impacts of low-level nitrofurans exposures become evident. Science-based risk assessments can continue to provide guidance on policy prioritization.

4. **Develop partnerships to improve veterinary infrastructure.**

Enhancing veterinary education and the capacity of national veterinary services infrastructure in shrimp exporting countries could improve regulatory oversight of aquaculture products. Producer access to veterinary services and training in good production practices could reduce reliance on antimicrobials.

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